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(54) DECORATIVE LAMINATES

(71) We, FORMICA CORPORATION, a corporation organised under the laws of the State of Delaware, United States of America, of 4614 Spring Grove Avenue, Cincinnati, State of Ohio, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to the production of decorative laminates. More particularly this invention is concerned with modifications of the processes for producing decorative laminates with embossed surfaces which form the subject of our Patent No. 1,135,760.

In our earlier Patent we have described how the conventional method for preparing decorative laminates by heat- and pressure-consolidating a stacked assembly composed of a number of thermosetting synthetic resin-impregnated core sheets, typically of Kraft paper, and, above the core sheets, a print sheet carrying a printed decorative design and impregnated with a thermosetting resin which in the finished product will be transparent, is modified in a simple manner to produce an embossed decorative laminate by the use of an "embossing design", by which is meant a raised printed design which will impart a raised surface to the corresponding print sheet. Two alternative processes utilizing such an embossing design are disclosed in the earlier Patent. According to one of these processes there is prepared between two flat metal plates an assembly in stacked relationship of:

- (1) a plurality of thermosetting synthetic resin-impregnated core sheets, ..
- (2) the embossing design,
- (3) the print sheet,
- (4) a release sheet, and
- (5) cushioning.

after which the assembly is heat- and [Price 25p]

pressure-consolidated under conditions which do not deform the embossing design. After removal of the metal plates, cushioning and release sheet at the conclusion of the consolidation step, there is obtained a laminate which has an embossed surface which is, using an analogy derived from photography, a "positive" image of the embossing design. As described in the parent Specification, the embossing design may be formed on the reverse surface of the print sheet or it may be formed on a separate sheet.

The second process described in our earlier Patent differs essentially from the first in that the embossing design is positioned on the face of the release sheet remote from the print sheet, rather than between the core sheets and the print sheet. The need for separate cushioning material between the release sheet and the adjacent flat metal plate is avoided according to this second procedure, since the core sheets and print sheet which are to form the laminate provide the cushioning effect necessary to enable the laminate to be deformed on its surface whilst allowing the entire assembly between the flat metal plates to assume the flat surfaces, required by the use of flat metal plates. The embossed design which is obtained in this case is the reverse or "negative" of the embossing design, which, of course, does not form a component of the final product. In this instance, the embossing design can be formed on a sheet of paper which is superimposed above the release sheet, or in some cases it can be formed on that surface of the release sheet which is remote from the print sheet.

Several ways in which the embossing design may be printed are described in the parent Specification. Thus, it is suggested that the composition for forming the embossing design may be applied to the appropriate carrier surface by techniques

such as hand painting, air brush techniques, spray and stencil techniques and particularly silk screen techniques. Solutions or dispersions of comparatively high melt thermoplastic, thermosetting or thermoset resins are mentioned as being suitable compositions for forming the embossing design.

We have now discovered in accordance with one aspect of this invention that aesthetically appealing laminates can also be obtained by either of the processes described in our earlier Patent when the embossing design comprises a raised design of hard particulate matter adhered to a flat carrier surface by means of an adhesive printed in that design, and either (a) the print sheet carries a printed decorative design in at least two colors, (the term "color" including white), or (b) the print sheet is replaced by a decorative sheet which has a surface exhibiting a decorative design in at least two colors and which is impregnated with a thermosetting synthetic resin which is transparent when cured.

As was the case with techniques for forming the embossing means described in the parent Specification, the embossing design of this invention may be formed either on a separate sheet of paper, or on the print sheet (or decorative sheet) or release sheet according to which of the two alternative laminate-forming processes is employed. The particular carrier sheet selected is printed with a suitable flat design leaving an adhesive material in the printed areas. The type of printing employed depends upon whether or not the embossing design is to become a part of the final laminate, produced from the assembly. Where the embossing design is not to become a part of the final laminate, the printed flat adhesive design may be accomplished with a conventional printing ink which is adhesive until dried and hardened. Where the embossing design is to become a part of the final laminate, the flat design must be printed so as to be compatible with the print sheet. In addition to printing inks or the vehicles thereof, other adhesive compositions may be employed. Thus, various resinous materials which produce an adherent surface as a printed design may be similarly employed. For example, one can use thermosetting resins such as melamine-formaldehyde resins or other triazine-aldehyde resins, urea-formaldehyde resins, thiourea-formaldehyde resins and unsaturated polyester resins, as well as other adhesives such as various animal and vegetable glues or synthetic contact adhesives such as poly(cyanoethyl acrylate). As pointed out above, where necessary, the adhesive will be in a tacky condition when treated with the particulate materials described next.

Use is next made of small hard particles which are forced to adhere to the adhesive design thereby producing a raised design substantially immediately after the adhesive design has been printed and before the adhesive has had an opportunity to solidify and harden, where this aspect is to be considered. These small hard particles may be any one of a plurality of available materials such as sand, ground glass, sugar, salt and finely divided thermoset resinous materials. In order to achieve the adherence of these small hard particles to the adhesive design so as to produce a raised printed surface, one may print the adhesive design on the selected sheet such as by a silk screen printing process, the thus printed sheet is then passed through a zone containing the hard particles wherein the particles contact the adhesive print and automatically become bonded thereto. In those instances where appropriate, the sheet containing the design plus particles may next be dried to the thermoset condition.

As has been noted, the print sheet and decorative sheet are both characterized by the provision of a decorative design in at least two colors. In the case of the print sheets, the decorative design is applied wholly by printing techniques in known manner. In this art, the term "printing" is used rather broadly to denote any process in which a pigment is applied to the surface of a sheet in an accurately reproducible manner and therefor includes techniques such as hand painting and spraying through a stencil, as well as conventional printing methods such as the silk screen, gravure and thermographic processes. The decorative sheets which optionally may be used in place of the print sheets differ essentially from the print sheets only in that the decorative design which they exhibit is not provided wholly by a printing process, although printing may be used to produce a part of the design. For example, a decorative sheet having a surface which exhibits a decorative design in red and white may be obtained by applying red print to selected areas of a white surface obtained by the use of a pigmented paper. Many other ways of obtaining a decorative design in at least two colors without recourse at all to printing, or using printing techniques to apply only a part of the design, will readily suggest themselves to the skilled reader. For example, coloring agents can be added to the resin bath used to impregnate the decorative sheets. Another method is to immerse the sheet whose surface is to be colored in a heterogeneous dispersion of colorants. When the sheet is removed from the dispersion its upper surface will carry a film of the dispersion which after drying leaves a multi-colored design with

areas of different colours in haphazard arrangement. Similarly, a heterogeneous dispersion of coloring agents can be sprayed onto the sheet without the aid of a stencil or screen to produce a mottled design in two or more colors. Still another method involves placing the sheet to be decorated on a turntable which is capable of rotating the sheet rapidly as it lies face up. Dabs of various liquid coloring agents are dropped randomly on the sheet as it is rotated at a rapid rate and a random design is thus produced. A random decorative design can also be obtained by placing dabs of print pastes of different colours onto the surface of the sheet and then to use a draw blade to distribute the paste in a random manner over the sheet surface.

Whether a print sheet or decorative sheet is employed, the sheet is impregnated with a thermosetting synthetic resin which in the finished product will be transparent, so enabling the decorative design to be seen. Suitable resins for this purpose include, for example, melamine-formaldehyde and other triazine resins, urea-formaldehyde resins, thiourea-formaldehyde resins and unsaturated polyester resin. In preparing the print or decorative sheets, the resin-impregnation step may precede or follow the application of the decorative design or, as has been noted, colouring matter may even be applied from the resin bath.

The print and decorative sheets preferably are formed of α -cellulose paper.

Of course, the embossing design and the decorative design on the print or decorative sheets will need to be aesthetically compatible.

In accordance with a further aspect, the present invention replaces the resin-impregnated print sheet employed in the processes of the parent Patent by a decorative sheet which has a surface either (a) of a single color, or (b) which exhibits a decorative design in two or more colors (the term "color" again including white) obtained at least in part by means other than printing and which is impregnated with a thermosetting synthetic resin which is transparent when cured. Such decorative sheets can be produced as described above in connection with the first-discussed modification of the parent invention, except, of course, that this second modification also contemplates the use of decorative sheets with a surface of a single color.

Except for the modifications hereinbefore

noted, the processes of the present invention may be carried out by the techniques described in the parent Specification, which techniques are in fact largely conventional. The reader's attention is also directed to the Specification of our Patent No. 1215971 which describes modifications of the parent invention according to which the embossing design comprises a raised design of hard particulate matter adhered to a flat carrier surface by means of an adhesive printed in that design and either (a) the print sheet has a surface of a single color or (b) the print sheet is replaced by a decorative sheet which has a surface of a single color and which is impregnated with a thermosetting synthetic resin which is transparent when cured.

WHAT WE CLAIM IS:

1. The process of producing a decorative laminate defined in Claim 1 or Claim 2 of Patent No. 1,135,760 modified in that the embossing design comprises a raised design of hard particulate matter adhered to a flat carrier surface by means of an adhesive printed in that design, and either (a) the print sheet carries a printed decorative design in at least two colors, or (b) the print sheet is replaced by a decorative sheet which has a surface exhibiting a decorative design in at least two colors and which is impregnated with a thermosetting synthetic resin which is transparent when cured.

2. The process of producing a decorative laminate defined in Claim 1 or Claim 2 of Patent No. 1,135,760 modified in that the print sheet is replaced by a decorative sheet which has a surface either (a) of a single color, or (b) which exhibits a decorative design in two or more colors, said decorative sheet being impregnated with a thermosetting synthetic resin which is transparent when cured.

3. A process for producing a decorative laminate, according to Claim 1 or Claim 2 and substantially as hereinbefore described.

4. A decorative laminate whenever produced by a process according to any preceding claim.

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